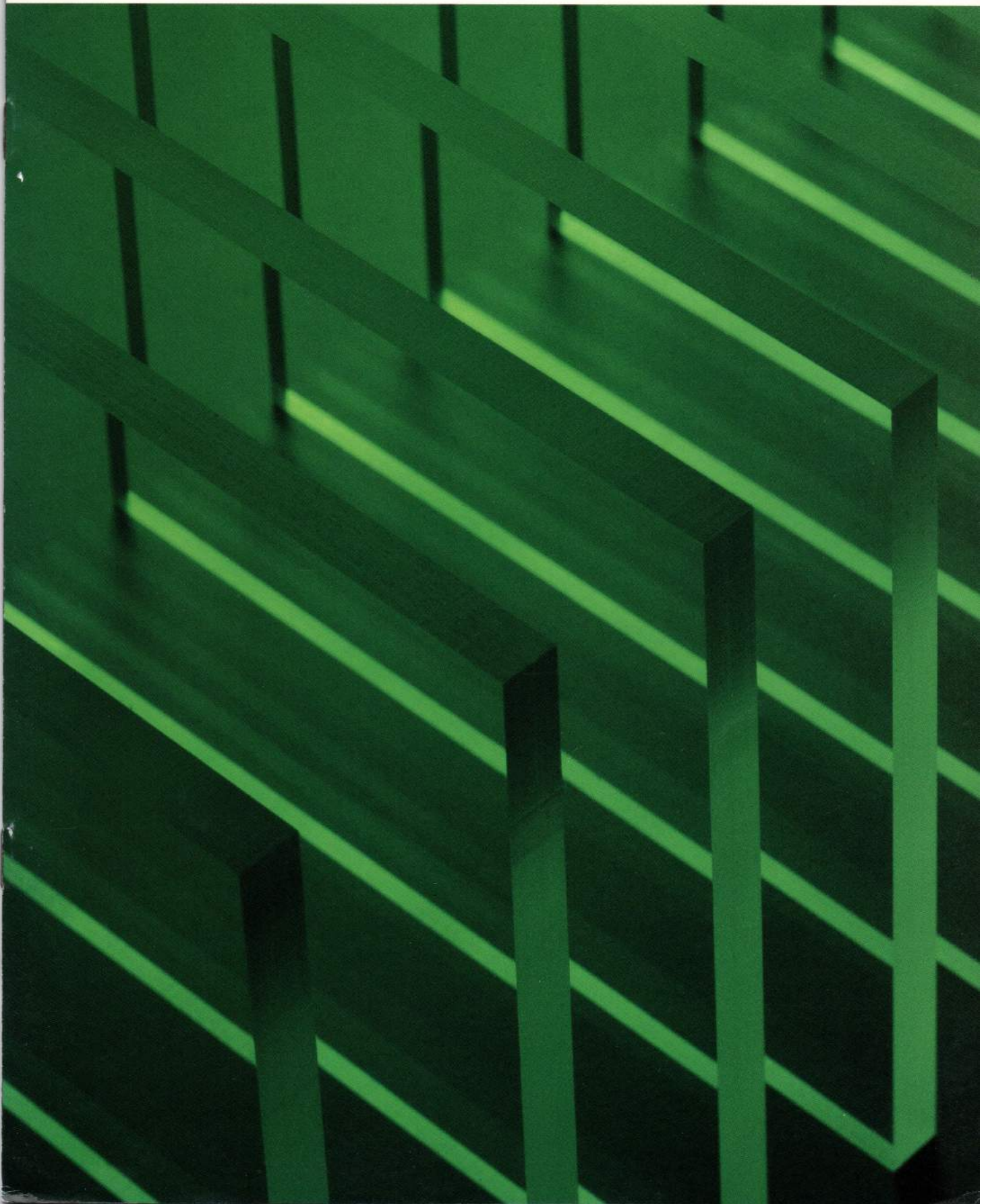


amdaahl

5990 Processors



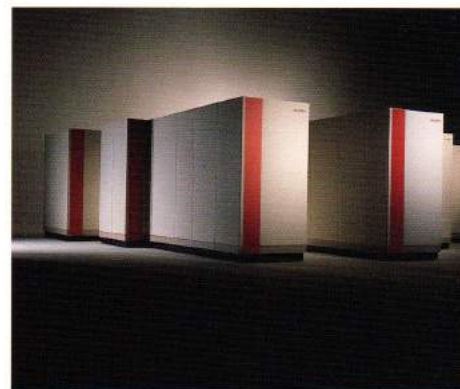
The Amdahl 5990: A New Generation of Advanced Processors

Amdahl's new generation of processors—the 5990-1400 four-way Multiprocessor and the 5990-700 Dual Processor—represents an extraordinary advance in high-performance, large-scale computing systems.

The 5990 models are Amdahl's vanguard processors, offering very-large-scale-integration (VLSI) logic chips at the forefront of technology, revolutionary board design, and very dense packaging. The result is unprecedented performance and a high degree of flexibility, giving customers the means to handle diverse processing demands as well as future growth. In addition, the 5990 processors

offer the reliable operation, compatibility with industry standards, and environmental advantages that are a tradition with Amdahl products.

All of these factors combine to make the 5990 processors the preferred choice for customers with demanding, intensive throughput requirements.



Increased Performance for Processing Advantage

To meet the ever-increasing capacity requirements of the large-scale processor environment, the 5990 models deliver exceptional processing power and performance.

With a 10-nanosecond (ns) cycle time and fast, 55-ns main storage chips, the 5990-1400 four-way Multiprocessor provides up to 50 percent more throughput capacity than the Amdahl 5890-600E four-way Multiprocessor.

The throughput capacity of the 5990-700 Dual Processor is up to 1.5 times that of the Amdahl 5890-300E Dual Processor in commercial online and batch environments. In a scientific batch environment, the 5990-700 provides up to 1.6 times the throughput capacity of the 5890-300E. And in a comparison of highly intensive floating point arithmetic programs, the 5990-700 delivers up to 2.0 times the performance of the 5890-300E.*

*Workloads used to measure relative performance are approximations of true production workloads. Relative performance for a specific customer workload will vary depending on the specific application and operating environment.

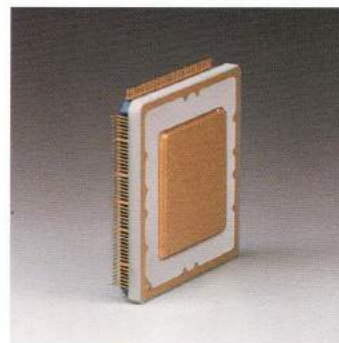
The 5990 processors' excellent performance levels are the result of:

■ *High-speed, emitter-coupled-logic (ECL) chips.* The 5990 processors use two types of VLSI ECL chips: extremely dense 10,000-circuit VLSI chips for registers, and very dense 3,000-circuit VLSI chips for most logic. Both types of chips have a switching speed of 180 picoseconds.

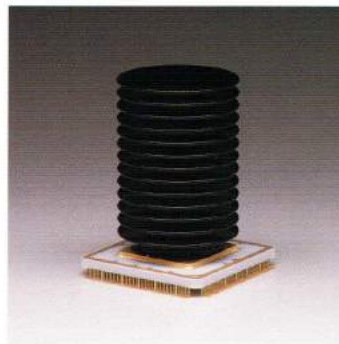
■ *Combined logic and random access memory (RAM) chips.* These special combination VLSI chips, used for buffers and microcode, contain 1,200 logic gates and have a 280-picosecond switching speed. They also contain 16 kilobits (kb) of RAM with a 2.8-ns access time. Placing logic and microcode on the same chip results in faster instruction execution.

■ *Static RAM (SRAM) memory chips.* State-of-the-art, 256-kb SRAM chips have a 55-ns access time. These chips permit a compact main storage unit and very rapid access to main storage data.

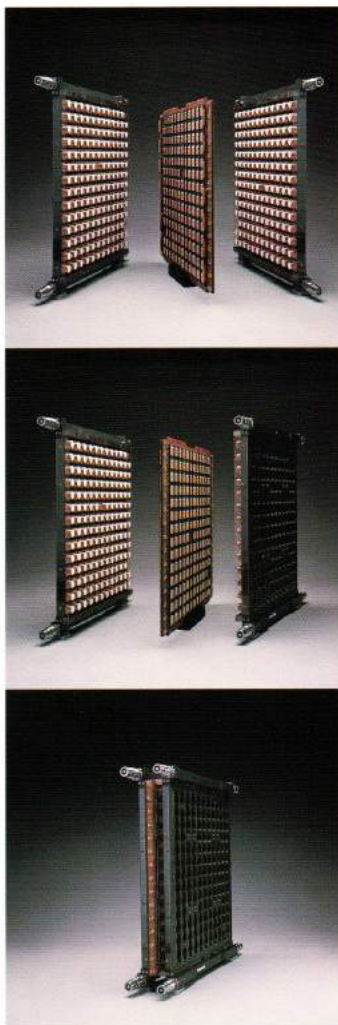
■ *Extremely fast machine cycle time.* The 5990 machine cycle time of 10 ns is the fastest of any System/370-compatible processor.



Combining 1,200 logic gates and 16 kb of RAM, this special VLSI chip is an example of innovative 5990 technology. Logic and memory on a single chip means improved performance.



Static RAM (SRAM) chips like this one, which require no memory refresh, provide very fast access to main storage data.



One double-sided subsystem carrier (SSC) can have up to 336 VLSI chips packed on a single 42-layer board. Most SSCs are encased in subsystem modules (SSMs) and cooled by the self-contained water cooling system.

■ *Advanced packaging techniques.* Subsystem carriers (SSCs) offer a new level of circuit integration, allowing Amdahl to provide higher performance by decreasing signal path lengths. This dense packaging technique distributes the implementation of the standard-configuration 5990-1400 Multiprocessor over only ten SSCs. A standard-configuration 5990-700 Dual Processor has just five SSCs.

■ *Central processing unit (CPU) on a board.* All the CPU functions reside on a single printed circuit board. A total of 336 VLSI chips are positioned on both sides of this 42-layer SSC.

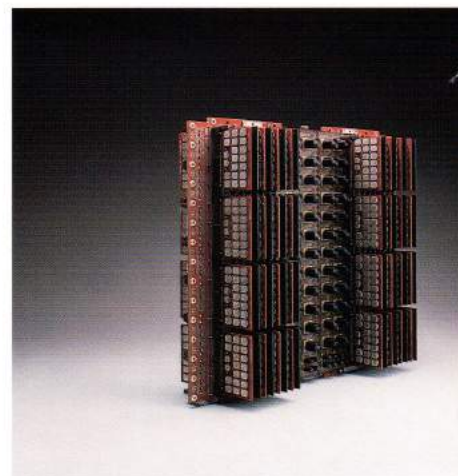
■ *Compact main storage.* One SSC can contain up to 128 megabytes (MB) of main storage. A fully configured 5990-1400 Multiprocessor has four main storage SSCs. A fully configured 5990-700 Dual Processor has two main storage SSCs.

■ *Innovative cooling.* Amdahl provides, installs, and maintains a self-contained water cooling system that sustains the fast circuitry, dense assemblies, and high integration of the 5990 processors. The CPUs, the channel subsystem processor, and the memory control unit are water cooled, but there is no requirement for user-supplied chilled water. In addition, air cooling is used in the main storage units, expanded storage units, channel units, the service processor, and the system console to help maintain Amdahl's traditional environmental advantages.

■ *Enhanced instruction pipeline.* To optimize throughput, a pipelined CPU design allows up to six instructions to be in separate stages of execution in each CPU simultaneously.

■ *High-speed buffers.* Separate 64-KB operand and instruction buffers and separate operand and instruction translation lookaside buffers (TLBs) allow the CPUs to operate near maximum execution rate by reducing references to main storage. TLB entries store segment table origins (STOs), eliminating the need for a STO stack. Six double-word instruction-fetch buffers, including two for pre-fetching a branch target instruction, minimize the likelihood of CPU wait time.

Each 5990 main storage unit is a single, air-cooled SSC containing up to 128 MB of memory.



Flexibility for Effective Use of Data Center Resources

Today's data centers are growing rapidly in size and complexity. Users have an increased need to access online data bases, information centers, and various office automation capabilities. In addition, the development and testing of new applications require a larger share of data center resources.

So that data center management can flexibly allocate data center resources to meet various demands, Amdahl offers the following value-added tools:

■ *Multiple Domain Feature (MDF).*

The optional MDF allows users to define and operate multiple system control programs (SCPs) on a single processor. Each SCP operates in an isolated domain that provides data integrity and processing security. Each domain has its own allocation of CPU, channels, and storage resources that the user can expand or shrink as necessary.

Users can define up to seven domains on a single-image 5990-1400 Multiprocessor and up to eight domains on a partitioned multiprocessor (four on each side). The 5990-700 Dual Processor can support up to four domains. A major advantage of MDF is that only *one* software license is required to run multiple copies of the same SCP in different domains.

A new MDF enhancement, the I/O Configuration Facility (IOCF), increases MDF flexibility by allowing users to attach many more devices than was possible previously. Each individual domain can access up to 4,080 devices—the maximum number of devices permitted by the I/O configuration program.

As an additional advantage, IOCF allows each domain to have an I/O configuration data set (IOCDS) that is independent of any other domain. Either identical or different

device addresses can be used in multiple domains. Thus, for example, a user could set up both a production and a test domain and select identical device identifiers in both domains to improve testing validity.

■ *Dynamic partition and join.*

Dynamic partition allows a user running a 5990-1400 Multiprocessor in single-image mode to vary one side of the system offline, leaving any SCP that supports partition and join still running on the online side. If the processor has MDF, the domains can remain active. The user can employ the offline side to bring up more SCPs, or power off that side for service.

The user may also create a single-image system by joining two partitioned sides of a 5990-1400 model. The SCP that was running before the join continues without disruption and may assume control of the additional resources.

■ *Channel enhancements.* Large channel configurations permit users to access a greater number of peripheral devices. A 4.5-MB-per-second transfer rate and data streaming are standard on block multiplexer channels.

■ *Expanded Storage feature.* Besides main storage, the user can add up to 2 gigabytes (GB) of optional expanded storage on the 5990-1400 Multiprocessor and 1 GB on the 5990-700 Dual Processor in increments of 128 MB. With MDF installed, the user can assign as little as 4 MB to each domain for increased flexibility.

■ *Field upgradeability.* Users can install the 5990-700 Dual Processor to meet current capacity needs, then upgrade to the 5990-1400 Multiprocessor for increased performance and flexibility. Channels, main storage, remote operator consoles, MDF, and expanded storage can be added to either model.



Amdahl's unique MDF enhances flexibility by letting users run SCPs in separate domains on a single processor.

Increased Reliability for Enhanced System Availability

As users become more dependent on computer services, preventing unscheduled system outages is increasingly critical. The 5990 processors are designed to have a minimum of failures and to allow timely, nondisruptive repair of those few failures. However, if a system should fail, it can be brought back up quickly and efficiently.

Plus, backing up each system is Amdahl's unsurpassed service organization, which has consistently ranked at the top of independent customer surveys.



Factors that result in the high reliability, availability, and serviceability (RAS) vital to users include:

- *High-density packaging.* Fewer components mean fewer failures and efficient fault isolation and repair.
- *Patrol function.* This independent facility periodically scans main storage, expanded storage, and some control storage, searching for and correcting intermittent single-bit errors. In the case of a permanent main storage error, the patrol function relocates the data on the failing component to alternate memory chips reserved for that purpose, thus reducing potential double-bit errors and increasing system availability.
- *Advanced error checking and correction (ECC).* The ECC technique used in the 5990 models involves single-bit error correction (SEC) and double-bit error detection (DED). The main storage unit also uses single-block error detection (SBED), which is capable of detecting single-block errors of three or four bits in a single four-bit block. ECC essentially eliminates system failures that would occur if a single bit fails. It operates in main storage, channel processor control storage, and control storage in the CPU instruction and execution units.
- *Redundant components.* Redundant components in the 5990 models limit unscheduled interruptions and allow processing to continue

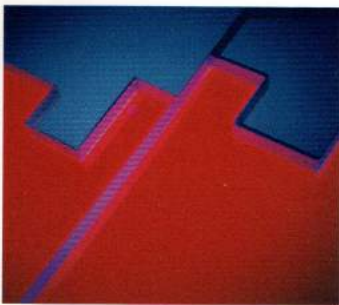
A patrol function optimizes the reliability of the 5990 processors by identifying errors in main storage and, if necessary, moving data from a failing component to an alternate chip.

undisturbed. For example, the main storage unit retains duplicate copies of key storage, each with parity.

- *Extensive history logic.* Each SCC contains combined logic and RAM chips that record the event history of each functional unit to provide useful data that increases serviceability. If an error occurs, recording stops and the event history is saved.
- *Automatic scan out analysis (ASOA).* ASOA is a service facility that analyzes scanned-out processor information automatically and displays a code on the main operator console, identifying the failing component. This technique reduces fault isolation time and increases system availability.
- *Extensive system monitoring.* The system power controller continuously oversees and provides early warnings for out-of-tolerance conditions in the power and cooling systems. The system activity monitor (SAM) displays CPU and channel activity, allowing customers to tune their applications and/or configurations for better allocation of computing resources.
- *Amdahl Diagnostic Assistance Center (AMDAC®).* Customers may link their 5990 processors to a console processor at AMDAC, where highly trained specialists in both hardware and software can provide timely recovery instructions and diagnostic assistance to the customer's site.
- *Failure Analysis System (FAS).* This facility processes failure data and transmits it to a corporate data base, allowing AMDAC specialists to observe trends and provide preventive action. FAS tracks and checks machine configurations and the field-replaceable unit (FRU) for proper hardware and microcode design levels, and also provides remote fix and update capabilities.

Compatibility for Investment Preservation

Compatibility with industry-standard architectural modes is an essential requirement for customers. Amdahl provides this compatibility and, at the same time, maintains product superiority. The 5990 processors run current SCPs and also attach to peripherals that conform to IBM channel interface standards, protecting the customer's investment in hardware, software, and people.



Amdahl's commitment to compatibility is exemplified by:

■ *Compatibility with industry standards.* The flexible 5990 processor implementation provides compatibility with System/370, System/370-XA, and Enterprise Systems Architecture/370 (ESA/370) architectural modes.

■ *Ability to run popular SCPs.* The SCPs listed below run on the 5990 processors. Specific details regarding SCP release levels are discussed in the software announcement that Amdahl publishes periodically. Amdahl will announce details about running MVS/ESA on 5990 processors after the MVS/ESA software and further information about ESA/370 become available from IBM.

- UTS® (an Amdahl native-mode implementation of AT&T UNIX®)
- VM/System Product High Performance Option (VM/SP HPO)
- VM/XA System Product (VM/XA SP)
- MVS/System Product Version 1 (MVS/370)
- MVS/System Product Version 2 (MVS/XA)
- MVS/System Product Version 3 (MVS/ESA)

Although some of these SCPs do not normally run on certain large processor configurations, customers can use Amdahl's optional MDF to run the SCP within an appropriately configured domain. MDF also permits users to operate dissimilar architectural modes—System/370, System/370-XA, and ESA/370—concurrently on the same processor.

The 5990 Series processors continue Amdahl's commitment to compatibility with industry-standard architectures.

Specifications

Configurations

Models	5990-700	5990-1400
Main Storage (MB)		
64	■	
96	■	
128	■	■
192	■	■
256	■	■
384		■
512		■
Channels		
32	■	
40	■	
48	■	
56	■	
64	■	■
80		■
96		■
112		■
128		■
Byte Multiplexer Channels		
Standard	1	2
Optional	15	30
Block Multiplexer Channels		
Standard	31	62
Optional	32	64
Main Operator Consoles	1	2
Coolant Distribution and Control Units	1	2
Options		
Multiple Domain Feature (No. of Domains)		
Single Image	4	7
Partitioned	—	8
Remote Operator Consoles	1	2
Expanded Storage (MB)	128-1,024	128-2,048

Physical Characteristics

Models	5990-700	5990-1400
Configuration: Main Storage x Channels	64 x 32	128 x 64
Power Capacity		
Requirements (kVA)		
50 Hz	3.5	7.0
60 Hz	3.5	7.0
400 Hz	18.4	36.7
Heat Dissipation		
kBtu/hr	69.3	138.6
kW	20.3	40.6
Floor Space, including all support frames		
Without Service Clearance		
ft ²	78.6	158.2
m ²	7.3	14.7
With Service Clearance		
ft ²	246.5	476.9
m ²	22.9	44.3
Weight		
lb	8,699	17,401
kg	3,946	7,893
Temperature Requirements		
Underfloor Air		
°F	50–67	50–67
°C	10–19	10–19
Room Air		
°F	59–90	59–90
°C	15–32	15–32
Humidity Requirements (%)		
Underfloor Air	50–70	50–70
Room Air	20–80	20–80
Customer-Supplied, Chilled-Water Requirements	none	none